CSC 7443 Visualization Projects

Submit your project work in print and electronically, which should include the project objective, methodology used, implementation details, user-interactive options, important outputs, performance analysis, future plan, references, and source codes.

Grading: 20 points

Deadline: Friday, December 4, 2015

Visualization Class Projects

Project 1: **Octree-based isosurface extraction**

Imaaduddin Ahmed, and Ibrahim Bashir

Project 2: **Texture-based visualization**

Diwas Bhattarai, and Alexandre De Siqueira

Project 3: **Visualization of tensor data**

Vikram Gowri Shanker, and Wenqiu He

Project 4: **Ray-casting volume rendering**

Xinbo Huang, and Neha Jose

Project 5: **Star coordinates visualization**

Gurminder Kaur, and Richard Platania

Project 6: **Visualizing time-varying data**

Dannissa Rodriguez, Simron Thapa

Project 7: **Star plot visualization**

Michael Thomas, and Celong Lui

Project 1: Octree-based isosurface extraction

Imaaduddin Ahmed, and Ibrahim Bashir

- Visualize a given scalar volume data using the octree-based Marching Cubes isosurface extraction method

  Download the data "DataDensity" (See Datasets under Project Assignment) and Marching Cubes code (see the Source Codes – Visualization)

- Implement octree to represent the scalar volume data

  Each octree node stores the minimum and maximum scalar values for the sub-volume it represents

  Provide option to vary the height of the tree, that is, the number of octree levels

- Provide the necessary user interactive options

- Generate isosurfaces for different isovalues and calculate the polygon generation and rendering times for each case

- Compare the extraction times between your octree-based method and the standard MC method

Project 2: Texture-based visualization

Diwas Bhattarai, and Alexandre De Siqueira

- Visualize a given scalar volume data using 2D or 3D texture mapping

  Download the data set "DataDensity" from the moodle site (see Datasets under Project Assignment)

  See the texture example (Source Codes – Visualization)

- Use a color map to display data (e.g., blue to red from the minimum to maximum scalar value) as texture – 2D or 3D texture

- Perform texture mapping with appropriate blending enabled

- Support a planar clipping and box clipping

- Provide the necessary user interface

Project 3: Visualization of Tensor Data

Vikram Gowri Shanker, and Wenqiu He

- Visualize given symmetric stress tensor data distributed on three dimensional grid of size 10 by using tensor glyphs
- Download the data “DataTensor-1” and “DataTensor-2” from the moodle site (see Datasets under Project Assignment)
- Display the tensor data points using ellipsoids and tensor axes on the grid
- You may use a color map to display different icons with different colors to encode additional information
- Provide the necessary user interface

Project 4: Raycasting Volume Rendering

Xinbo Huang, and Neha Jose

- Visualize a given scalar volume data by implementing raycasting method

  Download the data "DataDensity" from the moodle site (see the Project Assignment)

- Define a color transfer function for shading the data, e.g., assigning green to blue color for the scalar value ranging from the minimum to the maximum

  Apply a constant opacity (e.g., 0.1) for each scalar value

- Composite color and opacity values along ray at sample points in the front-to-back order

  $\alpha_{out} = \alpha_{in} + \alpha \cdot (1-\alpha_{in})$

  $c_{out} = c_{in} + c \cdot (1-\alpha_{out})$

- Obtain images of different sizes (32x32 pixels, 64x64 pixels, and 128x128 pixels) by shooting rays from all pixels in a direction parallel to the z-direction.

  Explore the effect of opacity on output image by using different values

  Display the output image using OpenGL or by some other means

Project 5: Star Coordinates Visualization

Gurminder Kaur, and Richard Platania

- Visualize multivariate elasticity data using the Star Coordinates technique
  - Download the elasticity data "DataCij-1" and "DataCij-2" from the moodle (see Datasets under Project Assignment)
- Implement star coordinates to support various options:
  - Varying the number of dimensions (radially laid out axes)
  - Coloring different data points (items or cases)
  - Highlighting the selected data
  - Dimension suppression
- Explore and highlight clustering structures
- Provide the necessary user-interface

Project 6: Visualizing Time-Varying Data

Dannissa Rodriguez, Simron Thapa

- Visualize 3D time-varying scattered data (atomic position-time series) from molecular dynamics simulations

  Download the data set "DataMD" from the moodle (see Datasets under Project Assignment)

- Display the data using particle rendering scheme (each data point rendered as a sphere)

  Vary the size and color to represent different atomic species

- Explore dynamical behavior of the data by using different techniques:

  Animation

  Trajectories (selective or all particles): Encode time-elapsed or distance traveled by the color of trajectories.

  Extract displacement (vector) data comparing two consecutive snapshots and render them

$$\Delta r_i = r_i\ (t+1) - r_i(t)$$

- Provide the necessary user interface

Project 7: Star Plot Visualization

Michael Thomas, and Celong Lui

- Visualize multivariate genes data (from micro-array experiments) using the Star Plot technique

  Download the gene data “DataGenes-1” and “DataGenes-2” from the moodle (see Datasets under Project Assignment)

- Implement star plot visualization method to support

  Multi-scale rendering

  Highlighting the selected data items or cases

  Dimension suppression

- Explore and highlight clustering structures

- Provide the necessary user-interface